Statement of Work for

AGARS G1000 Integration

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1 Background

This Statement of Work (SOW) includes background information about the Advanced General Aviation Research Simulator (AGARS) used by the Human Factors Department of the FAA in Oklahoma City, and specifies the requirements for adding G1000 to the present AGARS simulator. The department uses the simulator for running experiments to determine human factors needs in the general aviation community. The experimenters typically run a series of experienced pilots through pre-designed scenarios and record the pilots' responses. Recorded video, audio and computer aircraft data is then analyzed by the experimenter. AGARS is a fixed base simulator using high fidelity Fokker Electric Control Loader servos, and 220 degree out-the-window display (currently being added to the simulator).

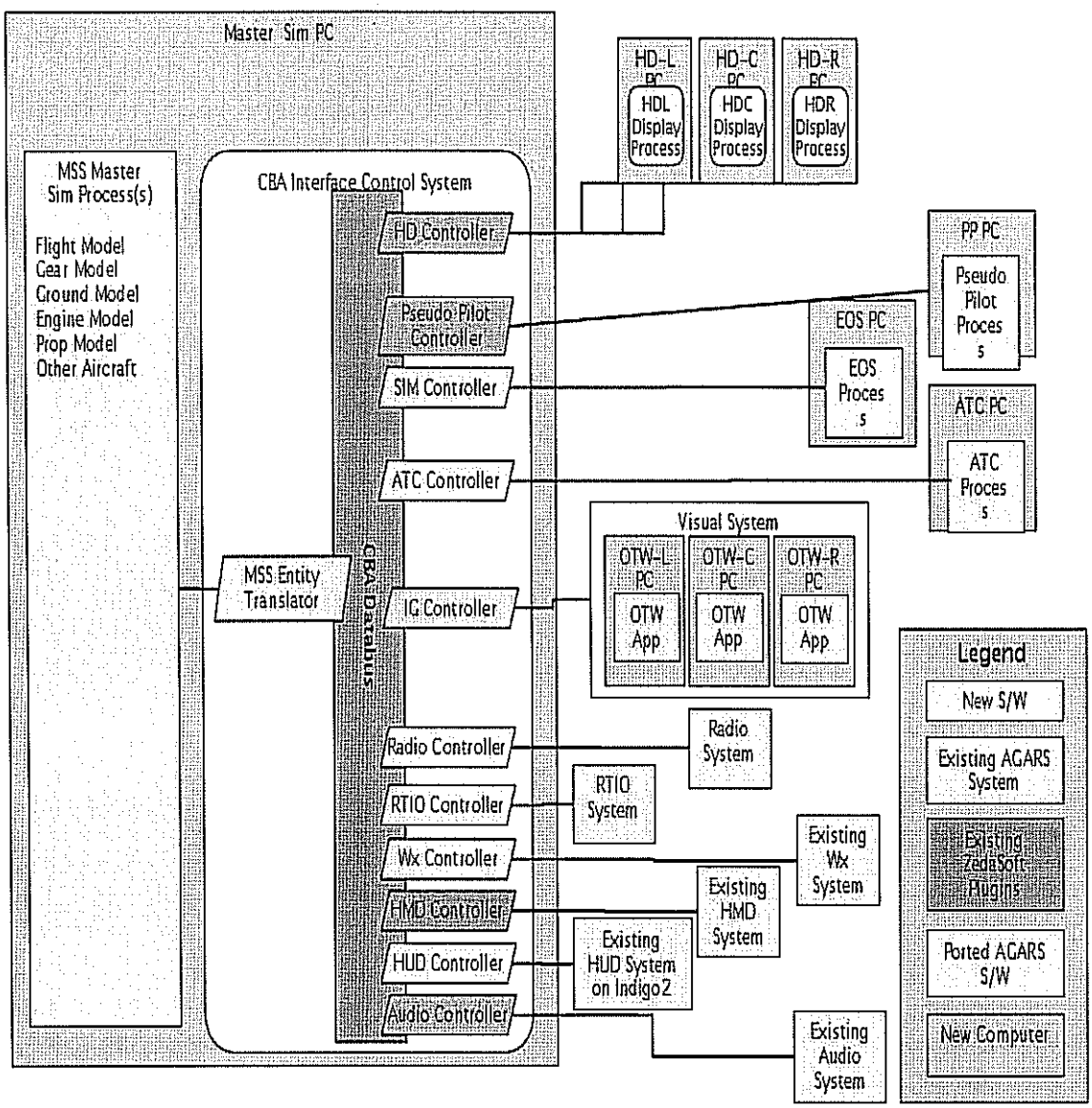
See Appendix I for simulator Pictures:

Currently AGARS is simulating, and restricted to, the 1995 Piper Malibu configuration with a Silver King radios and avionics. The Human Factors Department has demands for future studies that require adding other aircraft models in the AGARS simulator. The VLJ is the next aircraft model that is currently being added to the AGARS simulator along with an up to date cockpit panel and VLJ system cockpit I/O. This contract will give the department the ability to evaluate Technically Advanced Avionic (TAA) cockpits using the VLJ.

Current AGARS Computer Configuration

The Human Factors Department in Oklahoma City contracted to have AGARS ported from a SGI based computers running UNIX to Lynx PCs. The old simulator's Real-Time interface is called MSS, which was partially replaced with the Container Based Architecture (CBA) object oriented Java software interface. Most of the Piper Malibu Real-time software was left on the current system with the rest of the simulator interface and operating software replaced with the new CBA software. Currently, a Bihrle very-light-jet aircraft model is being integrated into the simulator.

FAA-CAMI AGARS Logical Software Diagram



FAA-CAMI AGARS System Diagram

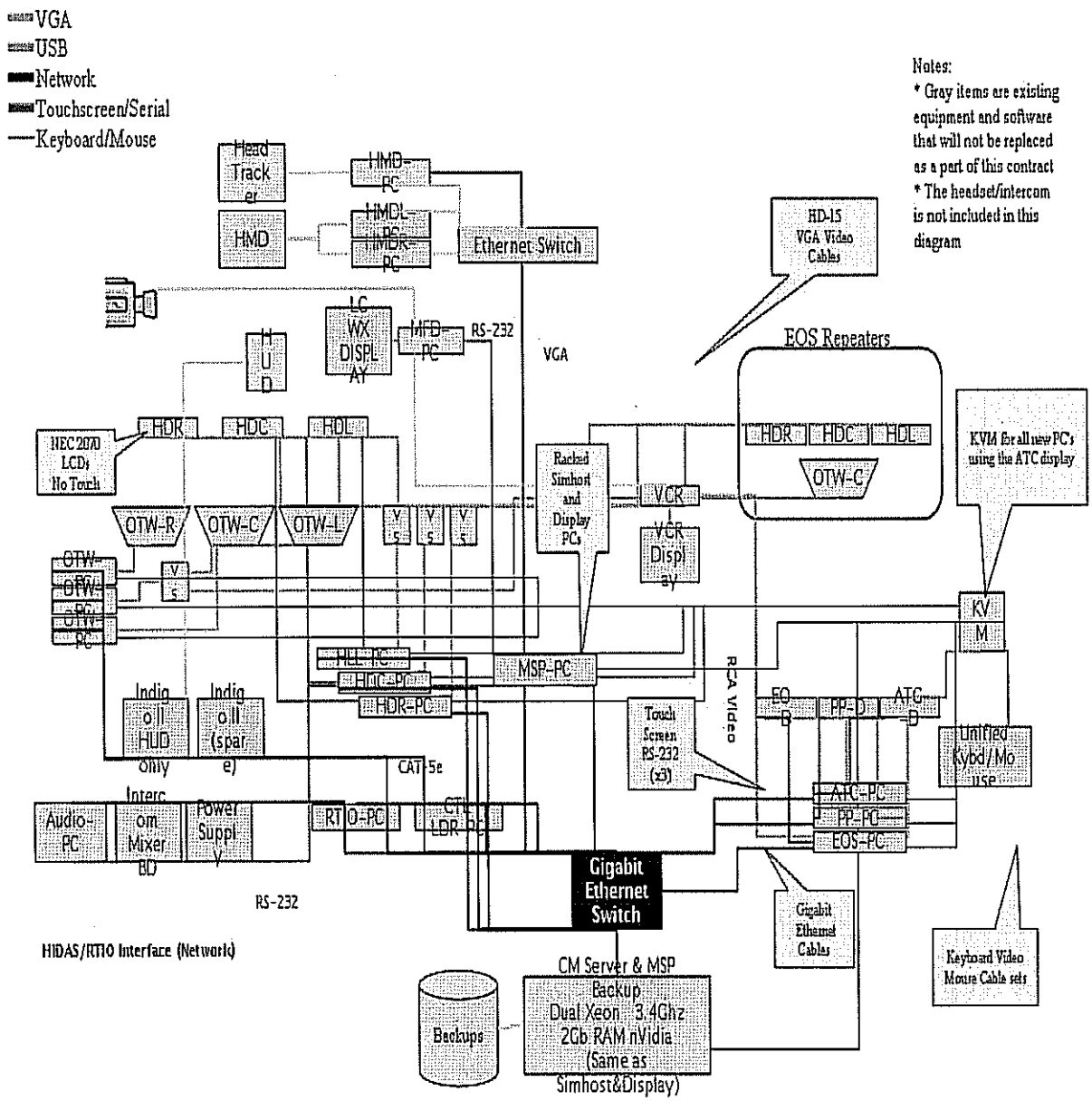


Figure 1 - Configuration of I/O System

Current Real-time computer configuration.

Presently AGARS has an I/O Intel PC computer that translates present hardware input/output through a HIDAS software integrator. The present real-time computer systems' components are:

Intel DUAL XEON 3.4GHz 3U Roackmount (Qunantity 3 – Simhjost, HD-Cockpit & CM)

- (2x) Intel Xeon 3.4GHz Processor w/@MB Cache (800Mhz FSB)
- Iwill DN800-SLI DUAL Xeon ATX Motherboard (Intel E7525) Chipset)
- 1 – X16 PCI-Express, 1- X16(X8) PCI-Express (Supports SLI) & 2 – 32-bit PCI Slots
- 2GB PC2-3200/DDR2-400 REGISTERED ECC RAM (2-1GB), Up to 8GB, 4 Slots
- (1X) ASUS GeForce 7900GT X !^PCI-Express Graphics Card w/256MB (Dual DVI+NTSC)
- Integrated 1 – Searil & Parallel & 2 – PS/2 & 1 – Firewire400 & 4 – USB 2.0 Ports

2 Requirements

2.1 Specific aircraft requirement

The objective of this contract is to add a G1000 integrated flight deck similar to the Cessna Mustang's G1000 flight deck into the AGARS simulator. The FAA Human Factors research lab requires that a G1000 suite be integrated with the new VLJ aircraft (Bihrle mustang flight model). The FAA desires a G1000 that closely resembles functionality and performance of the current system integrated into the Cessna Citation Mustang. Having the system closely function and perform as the real system, increases the external validity of the laboratories research and it also helps pilots' with actual real world G1000 experience have minimal training or transition time in order to fly the G1000 in the simulator. For the purposes of this contract, the contractor will demonstrate the similarities of the G1000 system being delivered and will document any differences between the system being delivered and the actual G1000 in the Cessna Citation Mustang.

2.2 G1000 integrated flight deck

2.2.1 The Contractor will provide the following G1000 systems

The contractor must provide a G1000 integrated flight deck. The system will simulate and/or stimulate a G1000 according to the following system information published in the G1000_CessnaMustang_PilotGuide_0435.11 or later.

This section provides an overview of the G1000 Integrated Flight Deck as installed in the Cessna Citation Mustang. The G1000 system is an integrated flight control system

that presents flight instrumentation, position, navigation, communication, and identification information to the pilot through large-format displays. The system consists of the following

Line Replaceable Units (LRUs):

- GDU 1040A Primary Flight Display (PFD)
- GDU 1500 Multi Function Display (MFD)
- GIA 63W Integrated Avionics Unit
- GMA 1347D Dual Audio System with Integrated Marker Beacon Receiver
- GDL 69A Satellite Data Link Receiver
- GWX 68 Weather Radar
- GCU 475 MFD Control Unit
- GMC 710 AFCS Control Unit
- GA 36 GPS/WAAS and GA 37 GPS/WAAS/XM Antennas
- GSA 80 and GSA 81 AFCS Servos
- GSM 85A Servo Gearboxes
- GFC 700 Automated Flight Control System (AFCS)
- SD Card-Terrain, Airport Terrain
- Obstacle database
- Aviation database
- Chartview
- Safe Taxi
- JeppView
- SD Loader Card
- SD TAWS Unlock card
- PFD Master Config. Module
- Synthetic Vision System (SVS)

A top-level G1000 system block diagram is shown in Figure 1-1 on page 6 of the G1000_CessnaMustang_PilotGuide_0435.11 (it does not include the GA 36, GA 37, or GSM 85A).

In the Cessna Citation Mustang, the GFC 700 Automated Flight Control System (AFCS) provides the flight director (FD), autopilot (AP), and yaw damper (YD) functions of the G1000 system.

2.2.1.1 The contractor will provide the above mentioned functionality either through simulation of the functionality and/or by stimulation of the systems listed above. In addition, the contractor will need to provide the government an interface control document (ICD) that allows the systems to be driven from the current simulation host. The goal of the FAA is to have a G1000 integrated flight deck that functions as closely as possible to the actual G1000. A list of the systems being simulated and stimulated will need to be presented by the contractor to the Human Factors Research team. The contractor should provide a graphical representation of the top-down system functionality for clarification. The contractor will need to demonstrate that all

flight instrument functionality (primary and supplemental flight data), flight management systems, Automatic Flight Control Systems (AFCS), nav/com functionality, audio panel, engine indication system, crew alerting system, Annunciations/Alerts/Abnormal operations and hazard avoidance systems are operating according to the G1000_CessnaMustang_PilotGuide_0435.11 or newer document.

2.2.1.2 The FAA would like to be able to record the user's inputs associated with the G1000 (GDU 1040A, the GDU 1500, GMA 1347D, GCU 475 and the GFC 700). The contractor should provide a mechanism for recording all user interface inputs. These inputs should be constructed as an event marker (time stamp) coupled with the button interface associated the user input. These data should be written to a text based file format (comma delineated, XML, or something similar).

2.2.1.3 Weather radar (GWX 68) and the XM satellite capabilities will need to be present in the G1000 integrated flight deck. The XM satellite antenna should be provided and operational for testing. The contractor should provide an option to the contract to be able to drive the Weather radar and/or the XM satellite system with a scenario based system. Ideally, the system would include several canned weather scenarios. Additionally, the system would allow the FAA researchers to develop their own scenario-based weather that then could be displayed on the G1000 through either the GMX 68 or the XM satellite feed.

2.2.1.4 The Traffic avoidance system functionality (TIS or TAS) should be present and documented in the ICD how to implement and drive the traffic from the VLJ simulation host.

2.2.1.5 The contractor will provide the initial installation of the above mentioned databases. The FAA will be responsible for the continued maintenance of the database subscriptions.

2.2.2 The Government will provide variables from the VLJ simulation host that represents the following data systems that normally provide aircraft data for the G1000. They will format according to the ICD provide from the contractor. Additionally, the FAA will provide the continuing subscriptions for any of the required databases on the unit.

- GEA 71 Engine/Airframe Unit
- GDC 74B Air Data Computer (ADC)
- GRS 77 Attitude and Heading Reference System (AHRS)
- GMU 44 Magnetometer
- GTX 33/33D Mode S Transponder
- GTP 59 Outside Air Temperature (OAT) Probe

The following equipment is also connected to the G1000 system and interfaces with the GIA 63W and the representative data will also be sent from the simulation host to the GIA simulation:

- Becker RA 3502 – A remotely mounted ADF receiver that operates in the 190.0 kHz to 1799.5 kHz frequency band with 0.5 kHz channel spacing.
- Honeywell KN 63 – A remotely mounted 200-channel, 100-watt, all-solid-state digital DME transceiver that provides distance information to the G1000 system.
- Honeywell KTA 870 – Traffic Advisory System
- Honeywell KHF 1050 – HF Transceiver

2.3 Install and test software and hardware

The contractor shall install developed hardware and software into the AGARS system and demonstrate that the new components accurately function and represent the G1000 system in the Cessna Citation Mustang and the single engine piston pressurized model.

3 Schedule

The contractor shall accomplish all requirements within 24 weeks of the official award date.

4 Deliverables

The following items shall be delivered by the contractor:

4.1 Design documentation

The contractor shall develop, in contractor format, a top level design of the new G1000 system. Software design documentation should be high-level, but detailed enough to allow for the easy addition of new features, such as add data-link capabilities. The ICD should allow the FAA to easily interface with the G1000 integrated flight deck.

4.2 User documentation

The contractor shall develop user documentation that will allow AGARS system operators to easily operate, debug and maintain the system.

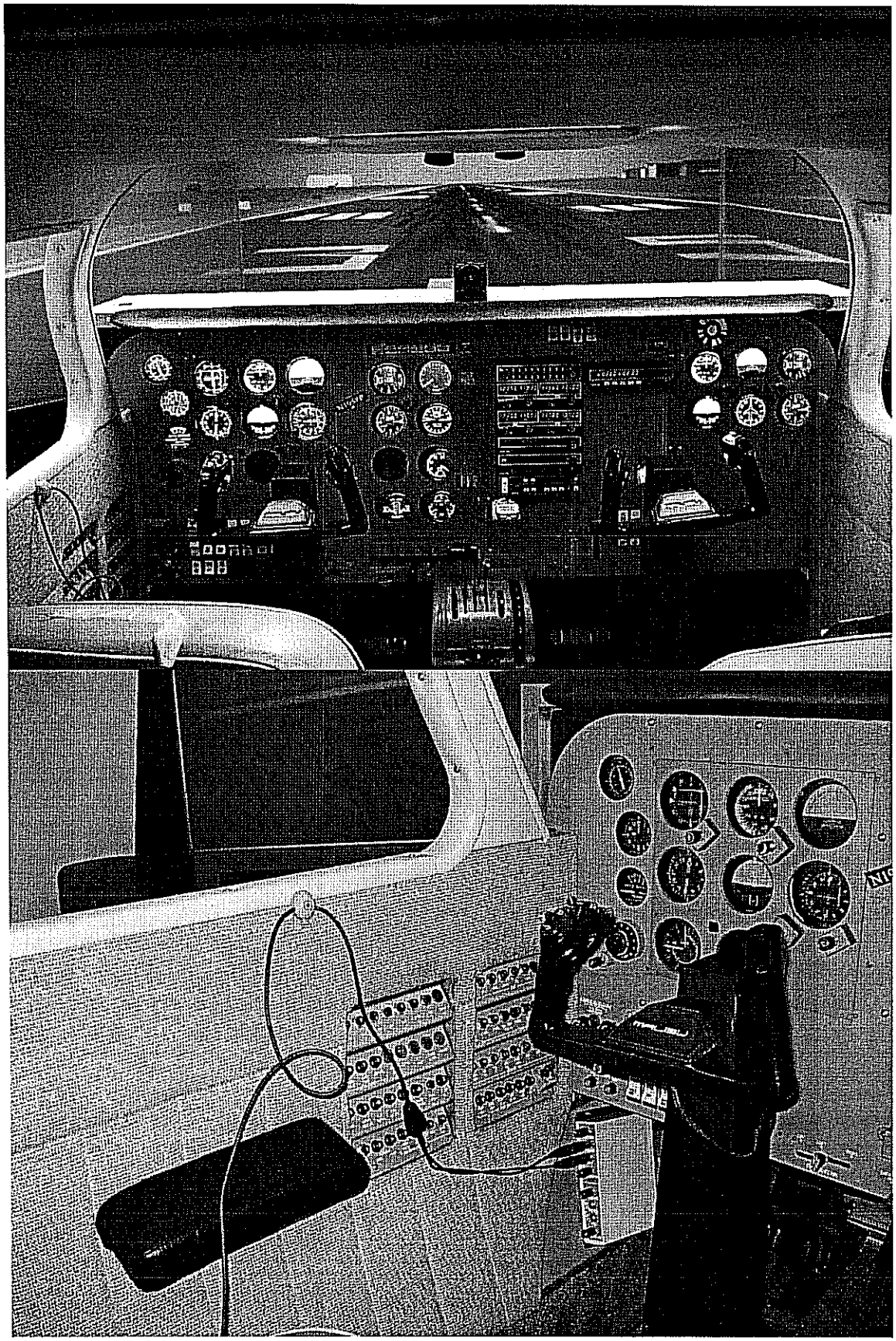
4.3 Final software products

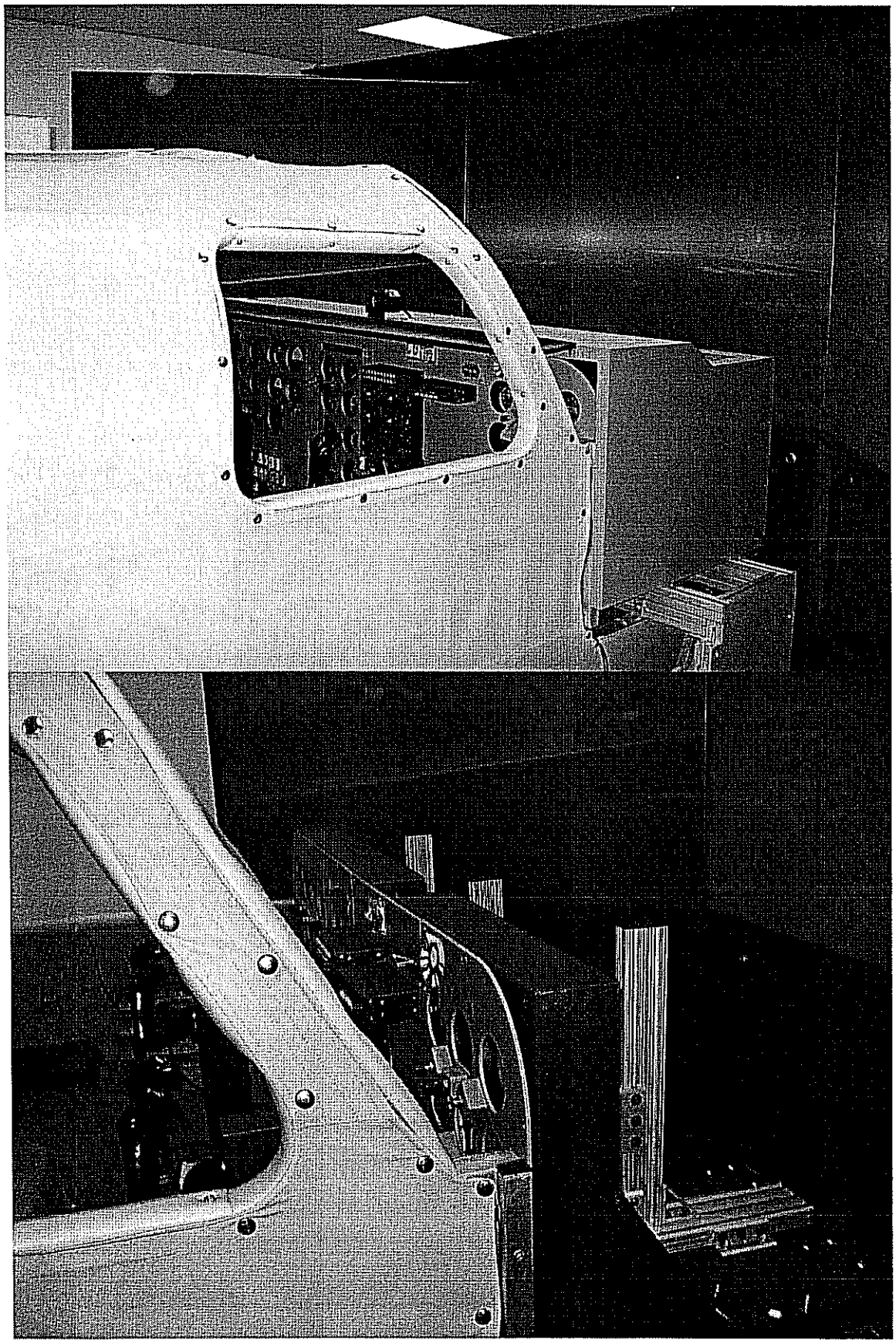
The contractor shall deliver all system software, application source code, and executable software.

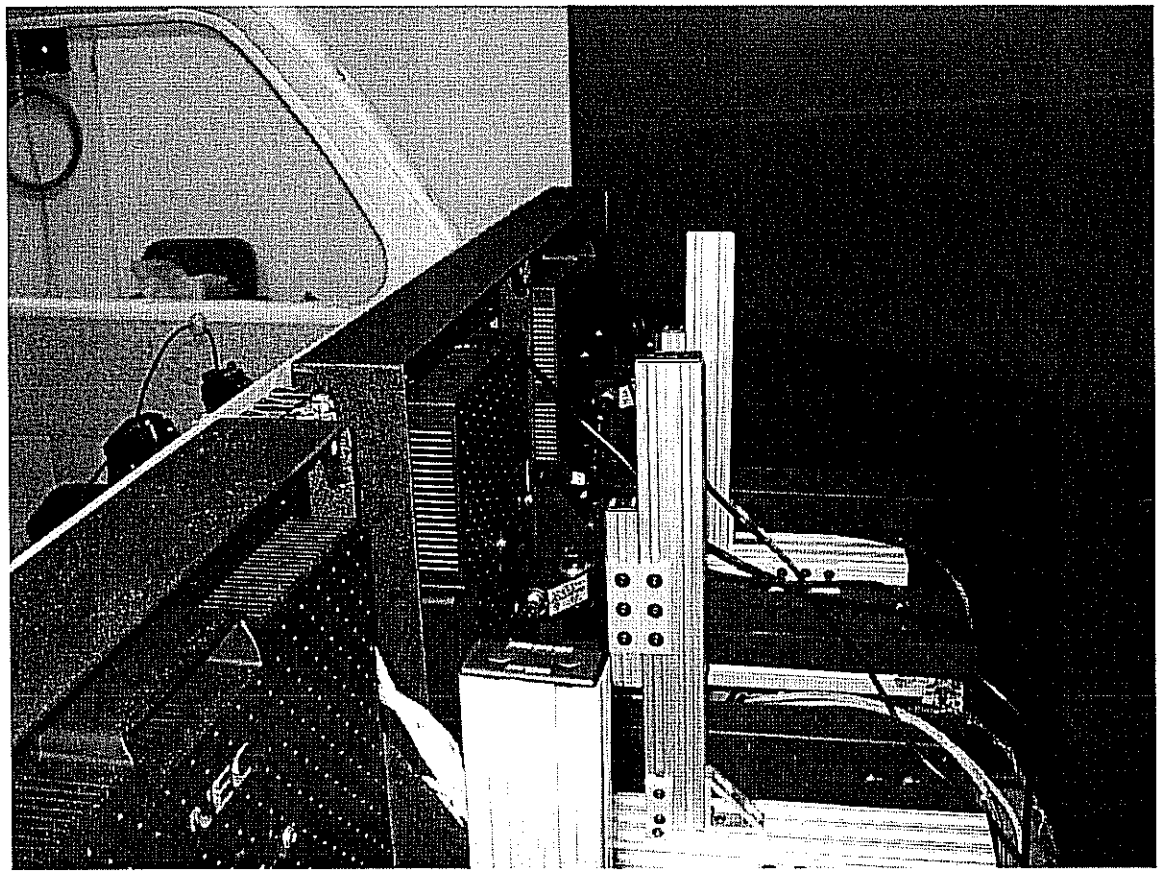
4.4 Final hardware products

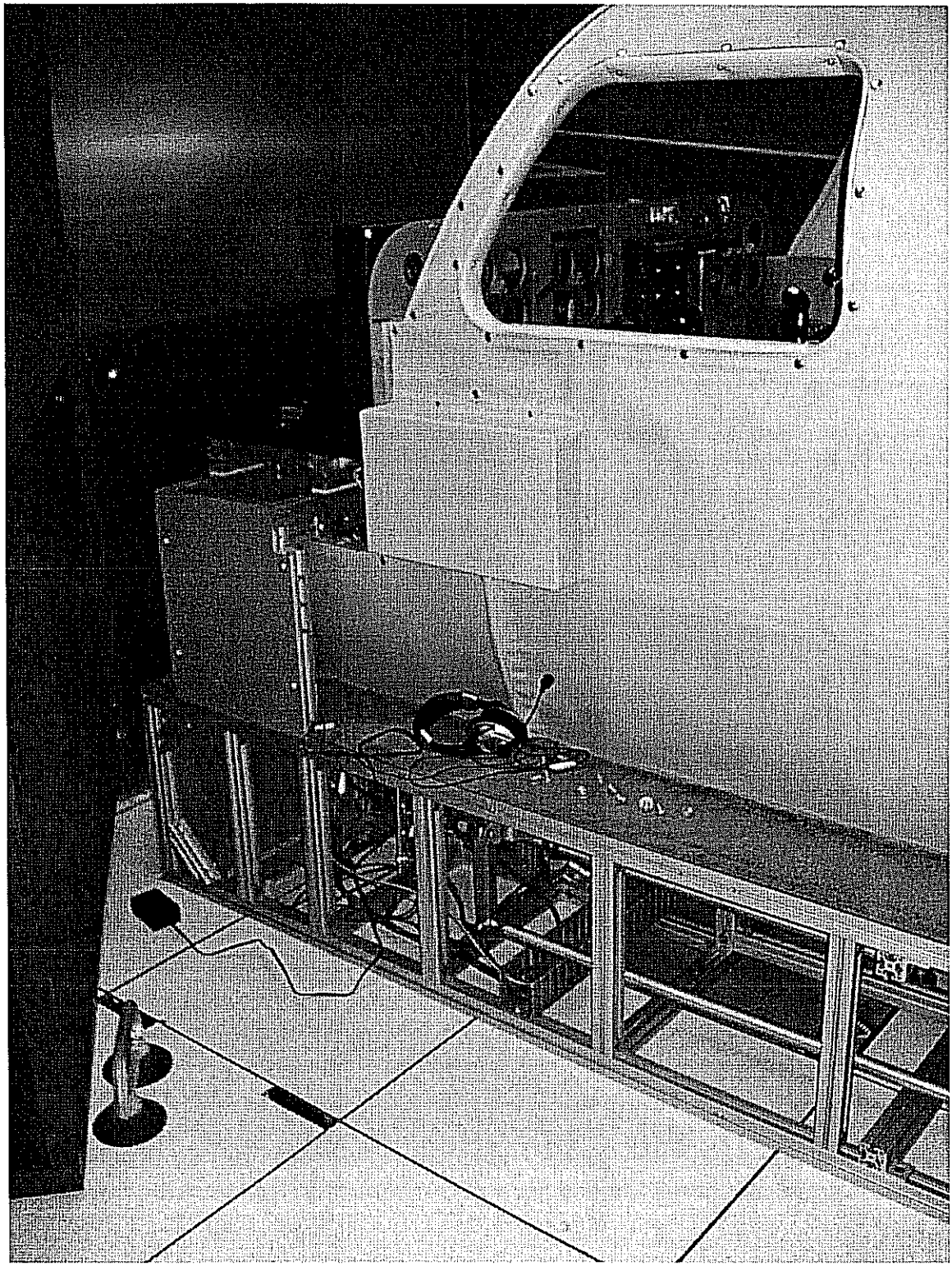
All hardware and computers purchased or developed for this program shall be delivered.

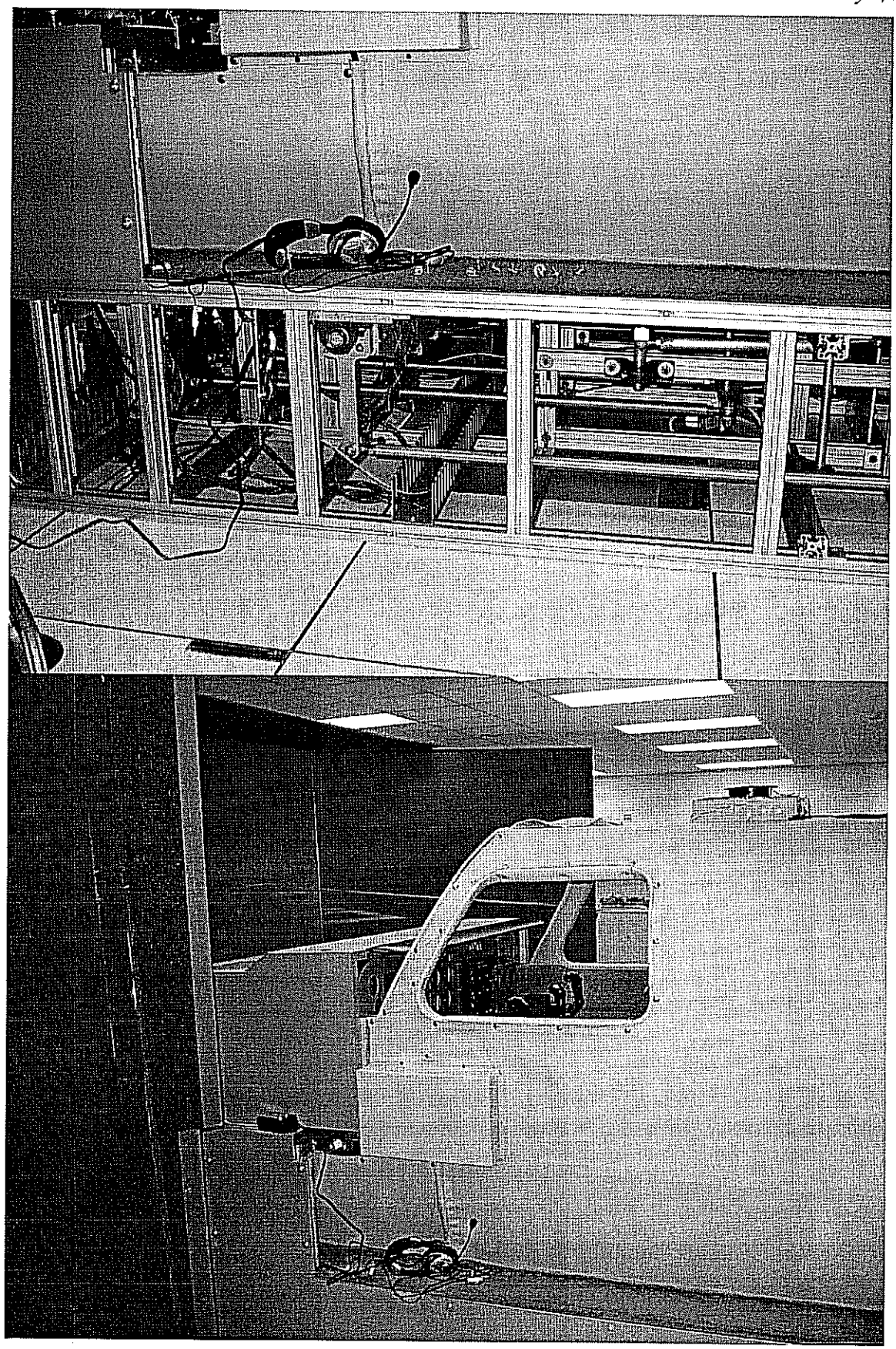
Appendix I



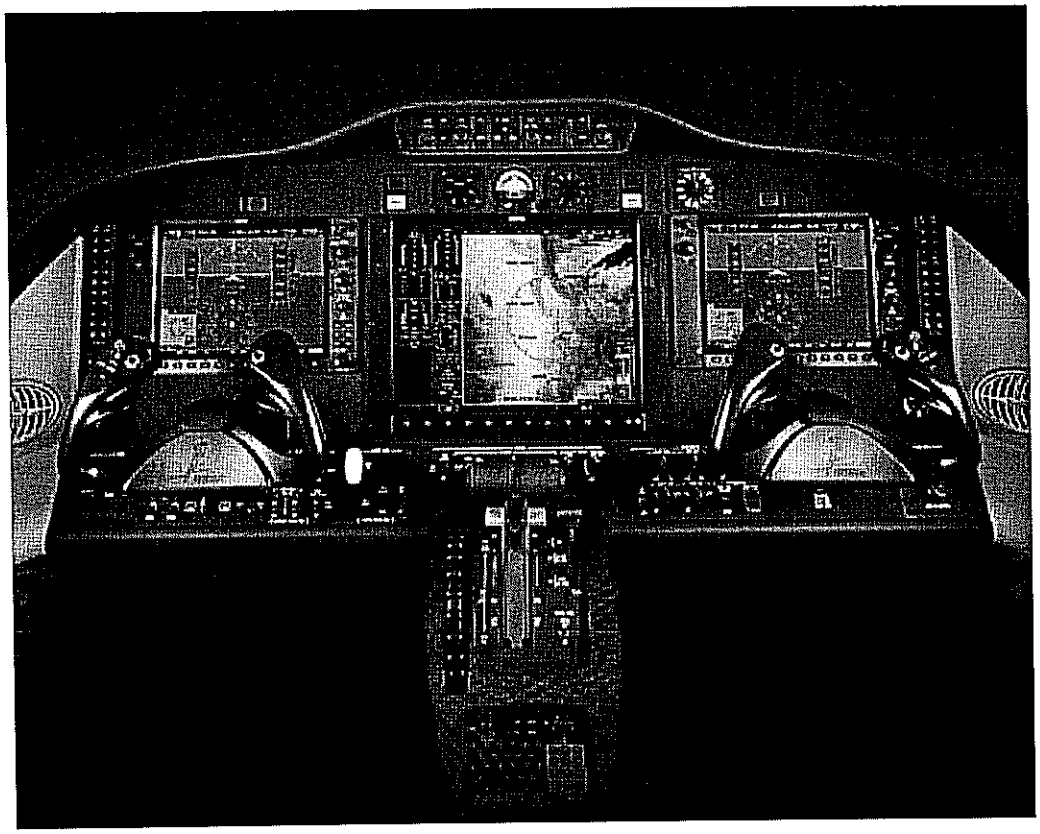








Appendix II



Cessna Mustang